

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-7 (canceled)

8. (currently amended) A ground and line fault interrupter comprising:

a magnetic core, wherein at the most three load wires of a three phase electrical circuit are fed directly ~~extend~~ through said magnetic core, and
5 wherein said magnetic core is capable of detecting a magnetic field from at least one fault current flowing through said load wires;

a unit of multiple conductive windings, wherein no more than one
unit of multiple conductive windings is wound on said magnetic core providing a first output voltage and a second output voltage and being magnetically coupled
10 to said magnetic core, wherein said first output is directly proportional to a line-to-ground fault level, and wherein said second output is directly proportional to a line-to-line fault level;

a first sensing circuit being electrically connected to said multiple conductive windings and monitoring said first output voltage, wherein said first
15 sensing circuit detects line-to-ground fault conditions between at least one of said load wires and ground;

a second sensing circuit being electrically connected to said multiple conductive windings and monitoring said second output voltage, wherein said second sensing circuit detects line-to-line fault conditions between
20 at least two of said load wires; and

25 a printed wiring board circuit breaker being electrically connected to an output of said first sensing circuit and an output of said second sensing circuit, wherein said printed wiring board circuit breaker receives a line-to-ground fault condition signal from said first sensing circuit or a line-to-line fault condition signal from said second sensing circuit, wherein said printed wiring board circuit breaker is tripped and generates an electronic fault signal when at least one of said received fault condition signals exceeds a preset threshold; and wherein said electronic fault signal activates an external circuit breaker system that is electrically connected to said three-phase system.

9. (previously presented) The module of claim 8, wherein each of said first and second sensing circuits includes:

5 an impedance with a first terminal and a first opposed terminal, the first terminal of said impedance being electrically connected to of said multiple conductive windings, wherein said impedance is a load that provides a voltage drop in said first or second output voltages;

10 a rectifier with a second terminal and a second opposed terminal, the second terminal of said rectifier being electrically connected to the first opposed terminal of said impedance, wherein said rectifier rectifies said dropped voltage;

15 an electronic filter with a third terminal and a third opposed terminal, the third terminal of said electronic filter being electrically connected to the second opposed terminal of said rectifier, wherein said filter characteristics are adjusted to balance a trip time with a number of false trips, and wherein said filter filters said dropped voltage; and

a comparator with a fourth terminal and a fourth opposed terminal, the fourth terminal of said comparator being electrically connected to the third opposed terminal of said electronic filter, the fourth opposed terminal of said comparator being electrically connected to the input of said printed wiring board

20 circuit breaker.

10. (canceled)

11. (original) The module of claim 10 wherein said three phase circuit includes at least one switch capable of receiving the electronic fault signal.

12. (original) The module of claim 11 wherein said three phase circuit is electrically connected to at least one load impedance through said at least one switch.

13. (previously presented) The module of claim 12 wherein said three phase circuit and said at least one load impedance are electrically connected through a conductive interconnect which extends through said magnetic core, said conductive interconnect being electrically connected in
5 series with said at least one switch.

14. (previously presented) The module of claim 8 wherein the output of said first sensing circuit is electrically connected to a first input of an OR gate and the output of said second sensing circuit is electrically connected to a second input of said OR gate wherein an output of said OR gate is
5 electrically connected to the input of said printed wiring board circuit breaker.

15. (canceled)

16. (previously presented) The module of claim 57, wherein said external electronic circuitry is in electrical communication with at least one of a fuel pump circuit, an engine circuit, and a gas pump circuit.

17. (previously presented) The module of claim 57, wherein said external electronic circuitry is positioned proximate to a flammable material.

Claims 18-22 (canceled)

23. (currently amended) A fault interrupter module comprising:
a relay socket module electrically connected to external electrical circuitry;

an ground and line fault interrupter adapter module fixedly
5 attached to said relay socket module, said adapter module including:

a magnetic core capable of detecting a magnetic field from
at the most three ~~least one~~ fault currents ~~current~~ fed directly through said
magnetic core;

a unit of multiple conductive windings, wherein no more
10 than one unit of multiple conductive windings provides ~~providing~~ a first and a
second output voltage, said multiple conductive windings being magnetically
coupled to said magnetic core;

first and second sensing circuits electrically connected to
said multiple conductive windings, said sensing circuits being capable of
15 detecting a line-to-ground fault from the first output voltage of said multiple
conductive windings and a line-to-line fault from the second output voltage of
said multiple conductive windings;

a analog operating circuit breaker detector electrically
connected to said sensing circuits, said circuit breaker outputting an electronic
20 fault signal when at least one of the line-to-ground and the line-to-line faults are
detected; and

a relay module electromagnetically coupled with ~~said~~ electrical
circuitry of said ground and line fault interrupter adapter module ~~circuitry~~, said

25 relay module being in electrical communication with said relay socket module through conductive interconnects extending through said magnetic core, said relay module including a switch electrically activated by the electronic fault signal.

24. (currently amended) A method of detecting an electronic fault in a circuit, the method comprising the steps of:

5 detecting a magnetic field from a fault current flowing through a switch in said circuit using a magnetic core and a unit of multiple conductive windings, wherein no more than one unit of multiple conductive windings ~~arranged~~ is wound on said magnetic core,

converting said fault current fed through said magnetic core into a line-to-ground fault signal and a line-to-line fault signal;

10 measuring the line-to-ground fault signal by comparing the ground fault signal to a ground fault reference signal;

measuring the line-to-line fault signal by comparing the line fault signal to a line fault reference signal;

constantly monitoring said fault signals;

15 tripping a circuit breaker detector if at least one of said ground and line fault signals exceeds a threshold;

generating an electronic fault signal;

opening said switch with said generated electronic fault signal to create an open circuit when the ground fault signal is greater than or equal to the ground fault reference signal; and

20 opening said switch to create an open circuit when the line fault signal is greater than or equal to the line fault reference signal.

25. (original) The method of claim 24 wherein said step of comparing the line fault signal to the line fault reference signal includes a step

of measuring a voltage across an impedance.

26. (original) The method of claim 24 wherein said steps of comparing the ground fault signal to the ground fault reference signal includes a step of measuring a voltage across an impedance.

27. (original) The method of claim 24 wherein said step of opening said switch includes a step of flowing a ground fault current greater than one Amp through said switch.

28. (original) The method of claim 24 wherein said step of opening said switch includes a step of flowing a line fault current greater than 90 Amps through said switch.

29. (canceled)

30. (previously presented) The method of claim 24 wherein said step of detecting the magnetic field with said magnetic device includes a step of inducing a current in said magnetic core.

31. (original) The method of claim 24 wherein said step of measuring the line and ground fault signals includes a step of rectifying at least one of the line and ground fault signals.

32. (original) The method of claim 31 wherein said step of measuring the line and ground fault signals includes a step of filtering at least one of the line and ground fault signals.

33. (currently amended) A method of detecting an electronic

fault in a circuit, the method comprising the steps of:

providing a three phase circuit including only three electrical sources electrically connected to an impedance load through ~~at least one~~
5 ~~conductive interconnect~~ and at least one switch and being directly fed through
at least one conductive interconnect;

measuring a current flowing through said at least one conductive
interconnect to determine a line-to-ground fault signal and a line-to-line fault
signal;

10 comparing the line-to-ground fault signal with a ground reference
current and comparing the line-to-line fault signal with a line current;

generating an electronic fault signal if said line-to-ground fault
signal or said line-to-line fault signal exceeds a preset threshold; and

opening said switch with said generated electronic fault signal to
15 create an open circuit if the line-to-ground fault signal is greater than or equal to
the ground reference current or if the line-to-line fault signal is greater than or
equal to the line current.

34. (previously presented) The method of claim 33 wherein said
step of measuring the current flowing through said at least one conductive
interconnect includes measuring a magnetic field with multiple conductive
windings.

35. (original) The method of claim 34, further including a step of
choosing the ground and line currents by choosing a number of turns in said
multiple conductive windings.

36. (original) The method of claim 33 wherein said step of
comparing the ground fault signal with the ground reference signal and the line
fault signal to the line reference signal includes a step of measuring a voltage

across an impedance.

37. (canceled)

38. (original) The method of claim 33 wherein said step of measuring the line and ground fault signals includes a step of rectifying at least one of the line and ground fault signals.

39. (original) The method of claim 38 wherein said step of measuring the line and ground fault signals includes a step of filtering at least one of the line and ground fault signals.

40. (original) The method of claim 39 wherein the step of filtering at least one of the line and ground fault signals includes a step of adjusting a frequency characteristic of an electronic filter to obtain a desired filter characteristic.

41. (currently amended) A method of providing electronic fault detection in a circuit, the method comprising the steps of:

5 providing at least one electrical circuit module in electrical communication with a connection in said circuit, said at least one electrical circuit module including at least one electrical interconnect and at least one switch;

removing said at least one electrical circuit module from said connection in said circuit;

10 providing an adapter module which includes electrical line-to-ground and line-to-line fault indicator circuitry, said adapter module being positioned in said connection in said circuit;

positioning said at least one electrical circuit module on said

adapter module, said at least one electrical interconnect extending through said electrical line-to-ground and line-to-line fault indicator circuitry to make electrical
15 contact with said circuit;

detecting a fault current flowing through said at least one electrical circuit module with said electrical line-to-ground and line-to-line fault indicator circuitry;

generating an electronic fault signal with said electrical line-to-
20 ground and line-to-line fault indicator circuitry;

transmitting said electronic fault signal from said adapter module to said at least one switch; and

opening said at least one switch when said electronic fault signal is detected by said at least one switch.

42. (canceled)

43. (currently amended) A ground and line fault interrupter, comprising:

a magnetic core, wherein at the most three load wires of a three-phase system are fed directly ~~extend~~ through said magnetic core, said load
5 wires providing three-phase power to an electrical load;

a unit of multiple conductive windings, wherein no more than one unit of multiple conductive windings is wound on ~~wrapped around~~ said magnetic core, wherein arrangement of said windings on said magnetic core enables monitoring of the current flow through said load wires and detection of
10 imbalances in the current flow;

a first sensing circuit electrically connected to said conductive windings, wherein said first sensing circuit electronically monitors said conductive windings and detects imbalances in the current flow through said load wires that indicate line-to-ground fault conditions;

15 a second sensing circuit electrically connected to said conductive
windings, wherein said second sensing circuit electronically monitors said
conductive windings and detects imbalances in the current flow through said
load wires that indicate line-to- line fault conditions; and
 an analog operating circuit breaker detector electrically connected
20 to said first and second sensing circuits, wherein said circuit breaker detector
receives a fault current from said first and second sensing circuits, and wherein
said circuit breaker detector is tripped and generates an electronic fault signal if
said received fault current exceeds a preset threshold.

44. (previously presented) The ground and line fault interrupter of
Claim 43, wherein said electronic fault signal generated by said circuit breaker
detector trips a circuit breaker of an external circuit breaker system that is
electrically connected to said three-phase system.

45. (previously presented) The ground and line fault interrupter of
Claim 44, wherein said circuit breaker detector is a printed wiring board circuit
breaker set to trip on a lower current draw than said circuit breaker of said
external circuit breaker system.

46. (previously presented) The ground and line fault interrupter of
Claim 43, wherein said electronic fault signal generated by said circuit breaker
detector trips a relay of an external relay system that is electrically connected to
said three-phase system.

47. (previously presented) The ground and line fault interrupter of
Claim 43, wherein said first sensing circuit includes an impedance electrically
connected to a comparator through an electronic filter and rectifier, wherein said
impedance is a load that provides a voltage drop which is rectified and filtered,

- 5 and wherein the characteristics of said filter are adjusted to balance a trip time with a number of false trips.

48. (previously presented) The ground and line fault interrupter of Claim 43, wherein said second sensing circuit includes an impedance electrically connected to a comparator through an electronic filter and rectifier, wherein said impedance is a load that provides a voltage drop which is rectified
5 and filtered, and wherein the characteristics of said filter are adjusted to balance a trip time with a number of false trips.

49. (previously presented) The ground and line fault interrupter of Claim 43, wherein said conductive windings are summed together to provide a first output voltage that is proportional to a ground fault level to said first sensing circuit and to provide a second output voltage that is proportional to a line fault
5 level to said second sensing circuit.

50. (previously presented) The ground and line fault interrupter of Claim 43, wherein the outputs of the comparators of the first and second sensing circuits are electrically connected to said circuit breaker detector through an OR gate.

51. (previously presented) The ground and line fault interrupter of Claim 43, further including a test circuit, wherein said test circuit is electrically connected to said conductive windings and enables manual input of a fault current.

52. (previously presented) The ground and line fault interrupter of Claim 43, further including a power supply electrically connected to said conductive windings.

53. (previously presented) The ground and line fault interrupter of Claim 52, wherein said power supply is a 115 VAC system without external connections.

54. (previously presented) The ground and line fault interrupter of Claim 43, further including a reset circuit electrically connected to said circuit breaker detector, wherein said reset circuit enables the manual reset of said circuit breaker detector if tripped.

55. (currently amended) A ground and line fault interrupter adapter module, comprising:

a plurality of relay interconnect throughholes capable of receiving external electrical interconnects of an electrical circuit module;

5 ~~a plurality of~~ at the most three socket pins extending said adapter module, wherein said socket pins provide electrical communication between said external electrical interconnects and a socket;

10 a plurality of bolt throughholes positioned proximate to the periphery of said adapter module, said throughholes receiving bolts that slide through, wherein said bolts secure said adapter module between said electrical circuit module and said socket; and

ground and line fault interrupter circuitry, including:

15 a magnetic core surrounding said socket pins, said socket pins being fed through said magnetic core, and said magnetic core detecting a magnetic field from the current flowing through said socket pins;

a unit of multiple conductive windings, wherein no more than one unit of multiple conductive windings is wound on ~~wrapped around~~ said magnetic core, said windings being arranged on said magnetic core to enable monitoring of the current flow through said socket pins;

20 first and second sensing circuits electrically connected to
said conductive winding, said sensing circuits detecting imbalances of the
current flow between each of said socket pins indicating line-to-line fault
conditions and detecting imbalances of the current flow between at least one of
said socket pins and ground indicating line-to-ground fault conditions, and
25 generating a fault current; and

a printed wiring board circuit breaker electrically connected
with said first and second sensing circuits, said circuit breaker receiving said a
fault current from said sensing circuits, wherein said circuit breaker is tripped
and generates an electronic fault signal when said received fault current
30 exceeds a preset threshold, wherein said generated electronic fault signal is
sent to said electrical circuit module.

56. (previously presented) The ground and line fault interrupter
adapter module of Claim 55, wherein said ground and line fault interrupter
circuitry further includes test circuit electronically connected to said conductive
windings and reset circuit electronically connected to said circuit breaker and
5 wherein said adapter module includes a control circuit panel providing control
switches for said test and reset circuits.

57. (previously presented) The ground and line fault interrupter
adapter module of Claim 55, wherein said socket is mounted on a panel, and
wherein said panel is in electrical communication with said socket and external
electronic circuitry.

58. (previously presented) The ground and line fault interrupter
adapter module of Claim 57, wherein said electrical circuit module includes a
circuit breaker system, and wherein said electronic fault signal activates said
circuit breaker system to interrupt the power supply for a load electrically

- 5 connected with said external electronic circuitry.